EUCLID INDUSTRIES

TECH TIPS

FOUNDATION AIR BRAKES

Includes:

Foundation Air Brake Hardware Kits

Camshafts/Camshaft Repair Kits

Automatic Slack Adjusters

Air Brake Chambers

Air Wedge Brakes

Air Hose

MODULE ONE

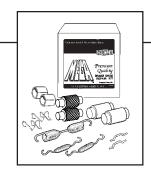


an *ArvinMeritor*, brand

TECHTIPS

FOUNDATION AIR BRAKE HARDWARE KITS

(Product Code 101)



FUNCTION

Air brake hardware kits are designed to provide **all** the components required to achieve maximum lining life, stopping power, and stability of the foundation brake at each reline. Each hardware kit is designed for a specific application; correct component identification is critical. Euclid Master Catalog 100 provides critical dimensions of all components for identification purposes. Wall charts are also provided to aid in brake shoe identification.

TYPE

In the aftermarket, air brake hardware kits are available in various quality levels and number of components in each kit. The end user should pay attention to these differences to assure that he is purchasing a quality kit from a reputable manufacturer. The old saying, "You get what you pay for," certainly applies to brake kits.

Euclid air brake hardware kits are available with a variety of components, from minor kits which range from some containing only high wear components, to the major kits which repair one complete wheel. These major repair kits are Euclid's MEGA PLUS Maximum Life, MEGA Premium Quality, and STOPMATE Standard Quality brake kits. Euclid MEGA PLUS kits are complete kits designed for today's "extended service" applications and provide for maximum life by using heavy-duty shot-peened return springs, dimpled anchor pin bushings and antiseize lubricant. Euclid MEGA heavy-duty brake kits include all the needed components including: anchor pins, rollers, heavy duty return springs, spring and roller retainers, washers, lock rings, and bushings. Euclid STOPMATE brake kits also include all the components needed to repair one complete wheel, but offer a standard quality level rather than a premium quality level with added durability. In this issue of **Tech Tips** we will highlight most of these components, their wear points, and types available.

GENERAL INSPECTION RECOMMENDATIONS

As foundation brake hardware wears, brake shoe and lining wear is affected. Brake lining wear patterns are a good place to start troubleshooting foundation brake hardware problems. Euclid supplies a Wall Chart (A-504) and a Service Bulletin (B-20) which describes possible causes and solutions to the most common brake lining wear problems.

BRAKE SHOES

Brake shoes need to be inspected for anchor pin connection wear (See Figure 1), roller connection wear, web straightness (See Figure 2), stretch (See Figure 3), and table flatness. Several styles of tools to check these wear points are available individually or as one unit such as Euclid's E-3863 Brake Shoe Gauge. Most brake shoe gauges are "GO/NO-GO" style and reject only those brake shoes which are worn beyond the minimum allowable dimensions. To achieve the best brake performance, old worn shoes must be discarded and replaced with new lined shoes.

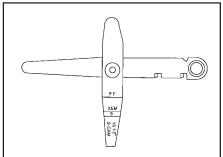


Figure 1 Figure 2

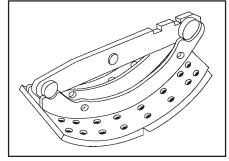


Figure 3

Euclid E-3863 Brake Shoe Gauge



ANCHOR PINS

Anchor pins position and maintain the position of the brake shoes. Brake force is transferred from the shoes through the anchor pin to the brake spider. As a result of normal movement and brake force, anchor pins will wear. As they wear, they no longer maintain the proper position of the brake shoes. This allows for unmatched lining to drum contact and inferior braking. Rockwell's designed brakes, "P" & "Q", are manufactured with two replaceable anchor pins, which, because of wear, must be replaced at each brake reline. Euclid supplies all replaceable pins with a precision ground finish to provide the smoothest possible wear surface, while other manufacturers often use a standard, ungrounded finish on their anchor pins. Eaton's non-replaceable single anchor pin must be closely inspected for wear and roughness. Make sure Eaton anchor pins are smooth and free of irregularities. Eaton's specifications allow for up to .031" of wear before the entire brake spider must be replaced. This .031" is the maximum wear limit however, and wear in smaller amounts may also cause brake shoes to be positioned incorrectly and create unusual wear on the brake lining. Roughness on anchor pins can cause faster wear on pins, bushings, and shoes.

Anchor pin heat treatment and depth of heat treatment also varies between manufacturers. Today's non-asbestos lining materials are lasting up to 50% longer than in years past, causing more wear on anchor pins. Euclid supplies only anchor pins that have been hardened to OE specifications, ensuring a consistent wear surface is maintained through the life of the brake lining. A thinner surface may be worn through at an interval between relines causing unstable and inferior braking.

Plating of anchor pins is the most obvious part to examine for wear when doing a brake reline job. Platings are available in black oxide, zinc, and in many Euclid MEGA Kits — hard chrome. All these platings provide good corrosion resistance before any brake force is applied to them. Hard chrome anchor pins are available in many Euclid kits which have severe service applications and provide the ultimate in wear resistance. **NOTE:** Anti-seize lubricant should be used in the assembly of anchor pins/bushings, regardless which plating and material is being used, in order to insure smooth rolling action and prevent corrosion.

ANCHOR PIN BUSHINGS

As anchor pins wear, so do anchor pin bushings. These bushings are included in all complete wheel brake kits where they are used and need to be replaced. Proper tools should be used to remove and install these bushings to avoid deforming them during installation. Inspect the anchor pin bushing hole in the brake spider for wear. If the hole is worn and cannot provide an adequate press fit to the bushing, the spider must be replaced. Special tools, such as E-3864B Brake Spider Alignment Tool, are also available to check the alignment of the anchor pin holes in the spider. If the spider holes do not meet specifications, the brake shoe will not be held square to the drum and the spider must be replaced.

Corrosion between standard mild steel anchor pin bushings and anchor pins is a common complaint. Euclid supplies a stainless steel version of these bushings in its MEGA and MEGA PLUS kits to eliminate this problem.

NOTE: Anti-seize compound should be used in the assembly of anchor pins/bushings, regardless of which plating and material is being used in order to insure smooth rolling action and prevent corrosion. Euclid's MEGA PLUS kits include a corrosion resistant non-magnetic stainless bushings with a dimpled inner surface to hold antiseize lubricant in place.

BRAKE SHOE ROLLERS

Brake shoe rollers transfer the force from the camshaft to the brake shoes. As the rollers move up the ramps of the camshaft, the brakes are applied. Brake shoe rollers are manufactured in two major types: smooth and knurled. Knurled rollers, like the diamond-knurled designed rollers supplied by Euclid, create a positive rolling action and when installed properly, eliminate flat spot problems on the head of the camshaft. Although knurled rollers may roll a pattern in the head of the camshaft, this pattern does not wear the camshaft. By staying in the same pattern it is proof that the roller is rolling much like gears in mesh and not sliding because sliding wears the camshaft. Some rollers are held in place during assembly by wire roller retainers. These retainers may be installed incorrectly and cause the best knurled roller not to turn. The most commonly mis-installed roller retainer is the E-3007A.



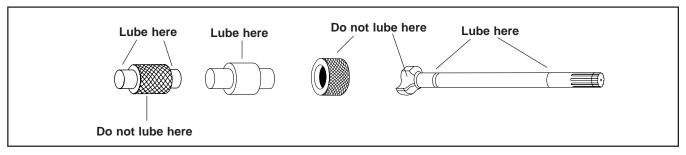


Figure 4

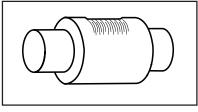


Figure 5

To aid the rollers in turning, only the pins must be lubricated (See Figure 4). DO NOT APPLY LUBRICATION TO THE ROLLING SURFACE OR HEAD OF CAMSHAFT. If lubrication is applied to either of these rolling surfaces, the rollers will tend to slide and not roll. This sliding action will create flat spots on the face of the roller and cause wear on the camshaft. Flat spots on rollers can cause brake adjustment to make very wide lining to drum clearance swings as these flat spots roll around (See Figure 5). Even without lubrication smooth rollers are still susceptible to flat spots.

BRAKE SHOE RETURN SPRINGS

Brake shoe return springs serve two important functions: 1) to prevent brake shoes from dragging on the brake drum; and 2) to maintain tight contact between the brake shoes, rollers, and the camshaft. These springs are also a major factor in release timing of foundation air brakes. Many uneven wear problems between wheels on a vehicle can be attributed to weak return springs. Brake return springs are manufactured for the heavy-duty market in different wire types, often designated as standard or heavy-duty. These wire types are not physically identifiable without specialized lab testing. Many end-users relate wire diameter to the classification of the return spring, (i.e., small diameter = standard, large diameter = heavy-duty). Although wire diameter is a factor in spring strength, it is not the only factor. Color coding between manufacturers is also something that will not indicate the strength of a return spring. Because there is no real in-field test that can determine the strength of a return spring, end-users must rely on their quality manufacturers for new springs and replace all return springs at each reline.

Brake shoe return springs, when nicked or marked, will most often fail at that mark. Care should be taken when installing new return springs not to nick them. A screwdriver between the coils must never be used to install springs. During manufacturing there is a slight possibility of a mark or imperfection on the spring. For this reason Euclid has always exceeded OEM spring specifications by shot-peening its MEGA and MEGA PLUS heavy-duty return spring to remove any stress that otherwise could cause the spring to fail or brakes to drag.

As we have examined each of the above components of brake shoe repair kits, it is clear that each and every part experiences wear through the life of the brake lining. Although this wear may seem small at a visual inspection, combined, it can cause very severe brake wear and performance problems. To insure maximum brake life and peak performance, all foundation brake hardware components must be replaced at each brake reline.

For over 50 years, Euclid has supplied brake components that are manufactured under the strictest quality controls in the industry. MEGA heavy-duty brake shoe repair kits include only premium quality components: stainless steel bushings, diamond-knurled rollers, and shot-peened heavy-duty return springs -- the best in the industry, **exceeding** OEM specifications. MEGA PLUS kits include the same high quality components of MEGA kits but add 100 lb. shot-peened return springs, dimpled anchor pin bushings, and antiseize lubricant. For the price-sensitive market segment, Euclid offers the STOPMATE standard quality brake shoe repair kit which features: zinc clear chromate plated and hardened anchor pins which resist corrosion, diamond-knurled rollers and standard or heavy-duty return springs. STOPMATE kits **meet** OEM specifications while Euclid MEGA and MEGA PLUS kits **exceed** OEM specifications.



EUCLID vs. COMPETITION

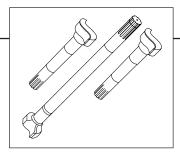
- Euclid brake kits meet or exceed OEM specifications in order to provide the vehicle owner longer life and improved performance on his investment in brake hardware.
- A higher quality brake kit will cost more initially, but will pay off in the long run with less wear on brake-lining and drums.
- The popularity of automatic slack adjusters and non-asbestos brake lining have increased the stress on foundation brake hardware. Thus, more heavy-duty, high quality parts such as Euclid's are required to meet today's stress loads.
- Euclid offers 80 cataloged brake kits covering a broad range of heavy-duty truck and trailer air brake applications.
- Euclid offers the finest and most detailed catalog information on air brake kits. A photograph and list of components is shown for each kit to ease in identification.



TECH TIPS

CAMSHAFTS

(Product Code 103)



FUNCTION

Air Brake Camshafts are part of a series of fulcrums and levers that transfer brake application force through the brake system. Force from the air brake chamber pushes the arm of the slack adjuster. The slack adjuster, mated to the Camshaft by splines, rotates the camshaft. The center of the camshaft becomes the fulcrum. When the "S" head of the Camshaft rotates, it delivers the brake force to the roller ends of the brake shoes and pushes them into contact with the brake drum.

TYPES

Camshafts are designed for specific brake applications. They are available in a variety of lengths, bushing journal diameters, head sizes, number of splines and spline diameters. Camshaft lengths are determined by the location of the air brake chamber.

Head sizes are determined by the type and size of the brake. A 15" diameter steering axle cam commonly uses a small "flat" type camshaft head. The 12 ½ diameter trailer brakes use small, but deeper, "S" shaped camshaft heads. The 16 ½ and 18" steering, drive or trailer axle brakes use large, "S" shaped camshaft heads on standard applications. Late model camshaft heads have evolved into the "extended life" design. These new heads for 16 ½ application utilize deeper pockets for use with the thicker brake blocks while using standards drums. Care must be taken when identifying these two camshaft types (See Figure 7). Standard head camshafts cannot be used when using "extended life" brake shoes. When using "extended life" camshafts, standard or "extended life" brake block can be used. Always use the same style camshaft on both sides of an axle to promote a balanced brake condition. As shown in Figure 6, the direction the camshaft head rotates to apply the brakes determines if the camshaft is "right hand" or "left hand". The side of the vehicle the Camshaft is located on has no bearing on whether the camshaft is "right hand" or "left hand".

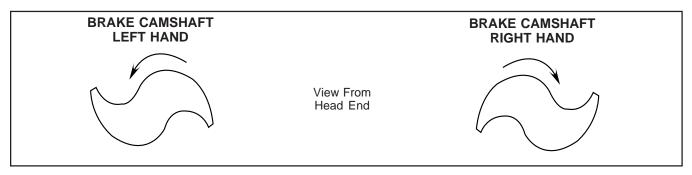
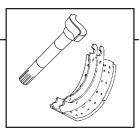


Figure 6



BRAKE SHOE IDENTIFICATION

(Product Code 103)

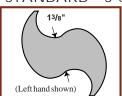


BRAKE IDENTIFICATION: "STANDARD" vs. "EXTENDED LIFE"

"STANDARD" BRAKES

"EXTENDED LIFE" BRAKES

"STANDARD" S-CAM HEAD



HOW TO USE THIS CHART

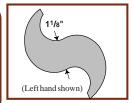
- Compare Brake Shoe Profiles
 Compare Table End Views
 Compare Brake Block Drill
- Patterns
 Determine Which Type of
 Camshaft Each Brake Shoe

"EXTENDED LIFE" S-CAM HEAD

"Standard" brakes use "standard" OR "extended life" camshafts.

Most "extended life" brakes use ONLY "extended life" camshafts.

Fruehauf brakes use ONLY "standard" camshafts.



BRAKE BLOCK DRILL PATERN TABLE

FMSI 4311J

FMSI 4311J

anchor end view
Use "std."
OR
"ext. life"
camshaft

EATON

EATON

EATON

EATON

EATON

EATON

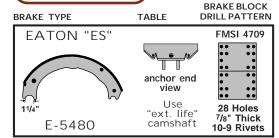
EATON

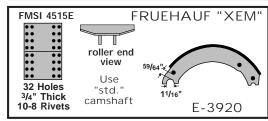
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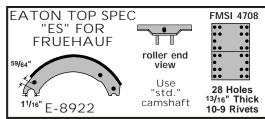
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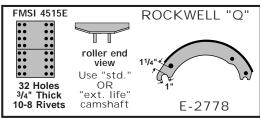
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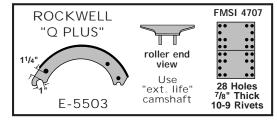
E-1778

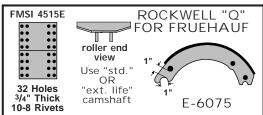


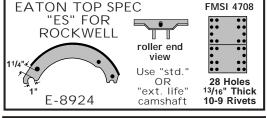


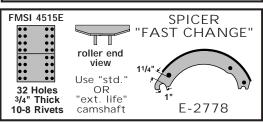












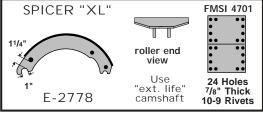


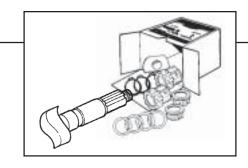
Figure 7

Full color reprints of this Chart (A-505) are available.

TECHTIPS

CAMSHAFT REPAIR KITS

(Product Code 104)



FUNCTION & TYPES

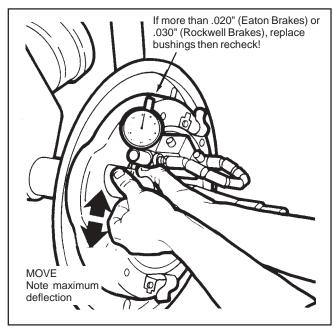
Euclid Camshaft Repair Kits are designed to restore camshaft operation to its original equipment specifications, providing the camshaft itself is not excessively worn. Euclid Camshaft Repair Kits come in many configurations to fit a wide variety of brake applications. They contain enough camshaft bushings, seals, washers and lock rings to service one complete axle (two camshafts).

GENERAL INSPECTION RECOMMENDATIONS

At each vehicle lubrication interval, any missing or loose camshaft lock rings and washers should be replaced. On self-contained tractor brakes, make sure that the chassis lubrication is not leaking between the camshaft tube and the brake spider. Replace the gasket if this occurs.

At each brake reline, certain inspection procedures must be performed on the camshafts and their related components. Camshaft radial movement should be checked with a dial indicator. If radial movement exceeds .020" for Eaton brakes or .030" for Rockwell brakes, the camshaft must be removed (See Figure 8).

Inspect the camshafts for wear, roughness, and/or deformed splines (See Figure 9), and replace as necessary. A knurled pattern on the camshaft "S" head is an indication that knurled brake shoe rollers were rolling properly on the "S" head. Smooth brake shoe rollers have a tendency to slide on "S" heads and cause them to wear. For this reason, Euclid always recommends the use of knurled brake shoe rollers.



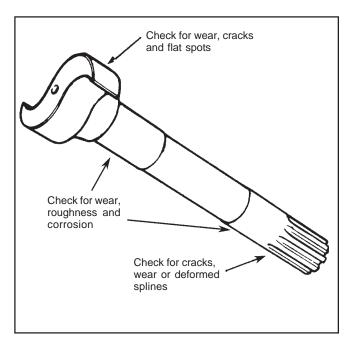
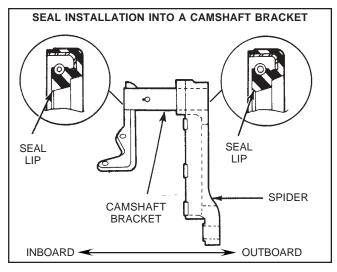


Figure 8 Figure 9



If camshaft bushings have been worn at any point, check the brake spider or camshaft support bracket before installing new bushings and seals. Wear in the spider or camshaft support bracket affect the fit of the bushings and help create excessive radial movement. Camshaft bushings and seals should be installed using the proper installation tools. For 1 ½" I.D. bushings and seals, use Euclid installation tool, E-1250; for 1 5/8" I.D., use part number E-2739.

When using self-aligning camshaft support brackets and bushings on trailer axles, do not completely torque the support bracket retaining bolts until the camshaft is installed through the bushing. After the camshaft is installed and the bolts properly torqued, the camshaft must turn freely by hand. If not, camshaft seals are commonly installed incorrectly. This can cause excessive grease build up on the camshaft head and brake shoe rollers. The correct installation of camshaft seals and "O" rings is shown in Figures 10 and 11.



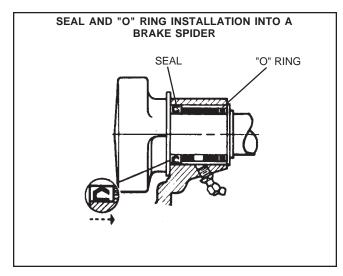


Figure 10 Figure 11





Place the camshaft head thrust washer onto the camshaft and lubricate the camshaft bushing journals before installing it. This makes camshaft installation easier and protects the seals from damage. When the camshaft is installed, it must

turn freely by hand to insure proper brake release. Place a spacer washer on the installed camshaft's spline end before putting the slack adjuster on.

After the camshaft, slack adjuster, washers and lock ring are in place, the camshaft axial movement must be checked with a dial indicator (See Figure 12). Eaton specifies axial movement be not less than .005" and not greater than .045". Rockwell specifies axial movement be not greater than .060". Axial movement can be brought within specifications by adding or removing camshaft spacer washers.

Note: A minimum of one camshaft spacer washer on either side of the slack adjuster is required. If proper axial movement cannot be achieved without removing one or both of these spacer washers, a slightly longer camshaft must be used.

Proper preventive maintenance and periodic service must be performed to insure camshafts and bushings will provide good service during the life of the brake reline. The intervals in which this service is performed depends on the vehicle application and road conditions. Each

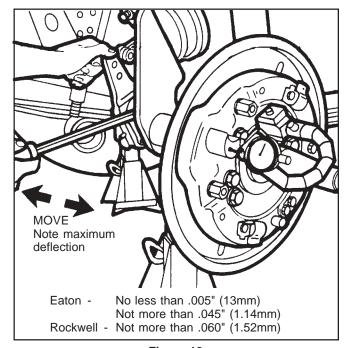


Figure 12

maintenance supervisor must design a preventive maintenance program that meets his own requirements. Euclid recommends that camshaft bushings be lubricated a minimum of every six months for on-highway vehicles and every four months for off-highway vehicles.

EUCLID vs. COMPETITION

- Over 400 Camshafts. One of the largest "all-makes" Camshaft offerings in the aftermarket.
- Heat-treated camshaft heads and splines to prevent premature wear.
- All Camshafts are individually boxed to prevent damage to splines.
- Camshaft Repair Kits contain all necessary parts to rebush one complete axle.

NOTE: For greater brake efficiency, Euclid strongly recommends that new camshaft bushings and seals be installed when replacing camshafts.



TECHTIPS

AUTOMATIC SLACK ADJUSTERS

(Product Code 108)

FUNCTION

As with a manual slack adjuster, Automatic Slack Adjusters multiply the linear force exerted by the air chamber and convert it to rotational force to activate the foundation brake components. The chamber force is multiplied by a factor

depending on slack adjuster arm length, (i.e., 5 ½", 6", 6 ½"). Through the use of a fixed control point (bracket or link) and a one-way clutch mechanism, the Automatic Slack Adjuster maintains proper lining to drum clearance. This eliminates the need for constant manual brake adjustment. Automatic Slack Adjusters provide consistent brake performance throughout lining life, better balance between individual brakes, and assist in keeping brake stroke within the legal limits.

Through normal brake operation, the fixed control point moves a rack in the slack adjuster body. As the clutches are engaged, on regular release, the worm screw is turned by the clutch and rack. The worm screw then turns the worm wheel adjusting the foundation brakes. This will continue until lining to drum contact is achieved. At the time of contact, the clutch to worm shaft is disengaged stopping worm wheel rotation as shown in Figure 13 (External Bracket Actuation).

During brake release, the actuation rod rotates the adjuster wheel in the slack adjuster body. As the clutch is engaged, the worm screw is turned by the adjuster wheel. The worm screw then turns the worm wheel adjusting the foundation brakes. This will continue until lining to drum contact is achieved. At the time of contact, the clutch to worm shaft is disengaged, stopping worm wheel rotation as shown in Figure 14 (Link Rod Actuation).

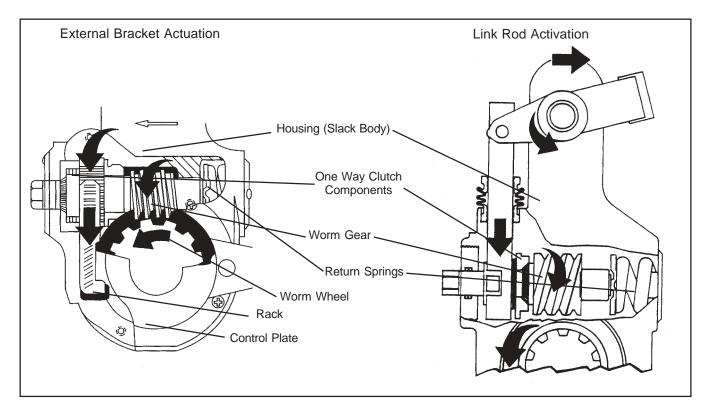


Figure 13 Figure 14



ADJUSTING SENSING METHODS

1) Stroke Sensing

In sensing push rod stroke, several variables come into play. Push rod stroke becomes longer when any one or a combination of the following are present: camshaft bushing wear, air chamber bracket deflection, or camshaft twist. Once a longer stroke is sensed, the adjusting mechanism in the slack is activated, reducing the lining to drum clearance. There is a possibility that with wear, push rod stroke could become longer than the legal limits while lining to drum clearance is correct. In a stroke sensing Automatic Slack Adjuster, this stroke activates the adjusting mechanism, further reducing lining to drum clearance and over adjusting the brake.

2) Clearance Sensing

The majority of Automatic Slack Adjusters produced today have lining to drum clearance sensing as the activation method. Clearance sensing slacks employ a one-way clutch and load sensing mechanism which engages only until brake application torque rises rapidly as brake shoes come into contact with drum. Push rod stroke and its characteristic wear points are less of a factor in operating clearance sensing Automatic Slacks.

GENERAL INSPECTION RECOMMENDATIONS

An Automatic Slack Adjuster should never be manually adjusted while in service. The only time it should be manually adjusted is during installation or reline. If manually adjusted frequently, the internal clutch life can be shortened. Automatic Slack Adjusters should be lubricated at all routine vehicle chassis lubrications: 25,000 miles, or three months, whichever occurs first. Some Automatic Slack Adjusters require the use of special lubricant to maintain warranty. Euclid Automatic Slack Adjusters require **no** special lubricant.

Check all control arm brackets, external links and/or external boots for damage. These are the most vulnerable areas that can cause improper operation of the adjusting mechanism resulting in Slack Adjuster failure.

The true test of an Automatic Slack Adjuster is "Does it maintain a proper shoe to drum clearance?" In a new installation the Automatic Slack Adjuster should automatically maintain stroke as listed below. If correct on initial installation, then during the brake lining life, the Automatic Slack Adjuster should maintain this stroke. The Automatic Slack Adjuster cannot be operated as a manual adjuster. If, on a new installation, proper stroke cannot be obtained; closely inspect the foundation brake for problems such as worn bushings, worn S-cam surfaces, flat spotted rollers, etc.

Air Chamber Size/Type	Desired Stroke	
Type 30 Air Chamber	1 1/4" to 2" stroke	with
Type 24 Long Stroke	1 1/4" to 2" stroke	80 to 90 psi
Type 20-24 Air Chamber	1" to 1 3/4" stroke	Service Brake
Type 9-12 Air Chamber	3/4" to 1 1/2" stroke	Application

The air chamber push rod stroke can be difficult to measure properly. With a tape measure, measure the movement of the push rod from the completely released position to the applied position (80 to 90 psi). This movement can also be measured by marking the push rod where it exits the air chamber (brake released), then apply the brake and measure the distance from the mark to the face of the air chamber.

The control arm location or clevis position should be checked if the brakes have been running tight or the push rod stroke measurement is less than $1^{-1}/4$ " on the rear axle or 3/4" on the steer axle.

If the stroke changes after a proper initial installation, foundation brake components should be checked before replacing Automatic Slack Adjusters. Look for worn camshaft bushing, worn camshaft, weak or broken return springs, etc. These components and their proper inspection and maintenance procedures can be seen in Euclid's training video "Air Foundation Brakes: The Hidden Challenge" (VIDEO-1).

Euclid offers two Automatic Slack Adjusters: Euclid/Haldex and Crewson Brunner. The features, benefits and proper operation of each is listed on the following pages.

EUCLID/HALDEX

Features Benefits & Advantages

Unhanded design Euclid/Haldex Automatic Slack Adjusters fit both left or right hand

applications, except for offsets which are available in 5/8" and 1 1/2" models.

Thus, greater product coverage results with fewer part numbers.

Available for 12 ¹/₄" brakes Euclid/Haldex Automatic Slack Adjusters are available for most 12 ¹/₄"

brake applications.

Quicker to install Euclid/Haldex uses existing clevis connection. Since clevis change is not

required, retrofit installation time can be cut in half.

Sealed to prevent contamination Euclid/Haldex uses a fixed control arm with a totally sealed body. With no

external boots, contamination failure is eliminated.

Easy manual adjustment Euclid/Haldex Automatic Slacks require no special procedure for de-

adjustment. Euclid/Haldex can be manually adjusted and de-adjusted at

reline or installation, the same as manual slack adjusters.

Unmatched warranty The Euclid/Haldex warranty has been extended to 6 years /1,000,000 miles

for on-highway vehicles.

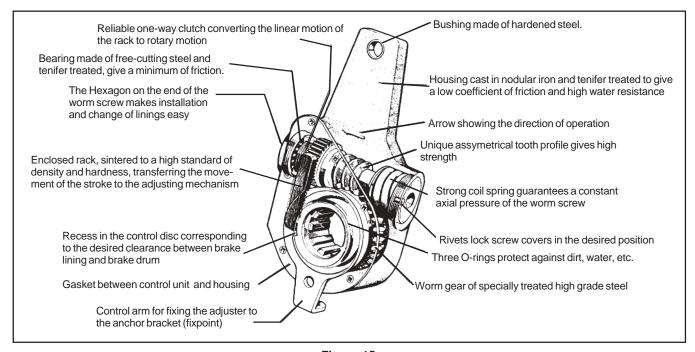


Figure 15

OPERATION (See Figure 15)

Upon brake application, the slack adjuster rotates and moves the shoes into contact with the drum. The clearance notch corresponds to the normal lining-to-drum clearance. As the brake application continues, the rack moves upwards and rotates the one-way clutch which overrides in this direction. As the brake torque increases, the coil spring load is overcome and the wormshaft is displaced axially, releasing the cone clutch.

When the brake begins its return stroke, the coil spring load returns to normal and the cone clutch is again engaged. The rack is pulled back to its original position in the notch, and any additional travel brought about by lining wear causes the rack to turn the locked one-way clutch and rotates the wormshaft through the locked cone clutch. The wormshaft then rotates the wormwheel and camshaft, adjusting the brakes.



CREWSON BRUNNER

AUTO SLACK SMART — MANUAL SLACK EASY

Benefits & Advantages **Features**

Clearance AND load sensing Less likely to overadjust than stroke or clearance-only sensing

Link rod actuation No external mounting brackets that can be damaged, easier installation

Adjusts on brake return Works with air chamber, shoe return springs, and brake components; not

against them - provides more consistent adjustment. This is important on

"new" long life brake designs.

Easy manual adjustment Does not require component disassembly or cause excessive component wear

Extra grease sealing provisions High integrity seals with built-in backup designs

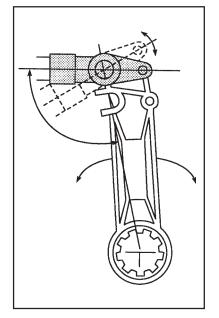
Minimal part numbers for total Reduces inventory cost complexity. Fewer part numbers than automatic product coverage

slack adjusters with external mounting brackets or stroke-sensing adjusting.

Patented - Hands Free Quickset and most foolproof installation method (Figure 16) Installation Guide

Outstanding Warranty Four (4) years or 400,000 miles, whichever occurs first, for on-highway trucks

tractors and trailers



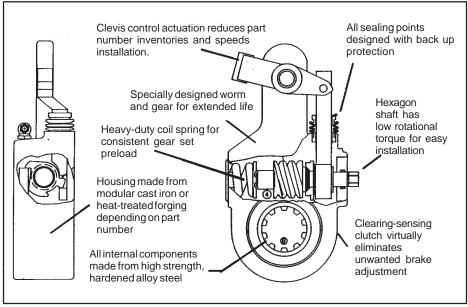


Figure 17 Figure 16

Operation (Figure 17)

As the brakes are applied, the Slack Adjuster's rotation moves the shoe and linings into contact with the brake drum. This movement also lifts the actuation rod through a pre-set, free travel dimension that is the normal lining to drum running clearance. Continuing the brake application rotates a one-way clutch in its overriding mode, and at the same time causes the large coil spring to deflect at a specific force. This spring deflection allows the worm to move axially, which releases the drive clutch and prevents unwanted brake adjustment from occurring.

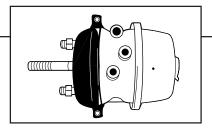
As the brakes are released, the large coil spring resumes its original load and position, which allows the drive clutch to re-engage. Simultaneous to drive clutch re-engagement, if any lining wear has occurred, the actuation rod rotates the one way adjusting clutch an amount proportional to the lining wear. This motion rotates the worm, worm wheel, and S-cam shaft, resulting in adjustment of the brakes.



TECHTIPS

AIR BRAKE CHAMBERS

(Product Code 131)



THE BRAKE CHAMBER

The Brake Chamber converts compressed air into mechanical energy. This conversion is accomplished by supplying compressed air against a diaphragm. The diaphragm then pushes against a paddle with an attached push rod and Clevis. The force of compressed air is now converted into mechanical braking force (See Figure 18).

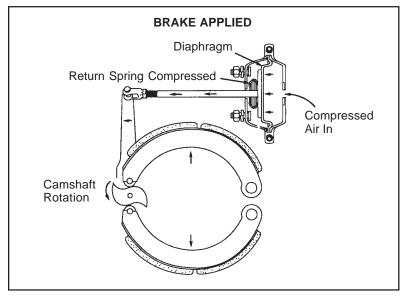


Figure 18

Braking force is discontinued when the compressed air is exhausted from the Brake Chamber (See Figure 19).

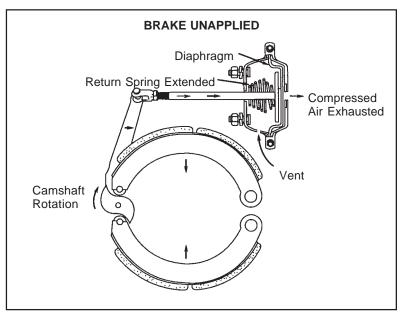


Figure 19

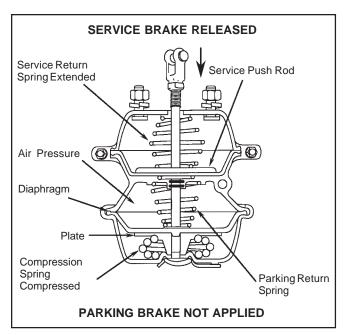
The Brake described above is a service brake chamber (See Figure 18 & 19). The combination brake chamber is another type of chamber. The combination chamber combines a parking brake piggybacked on a service brake (See Figure 20). The parking brake uses a very powerful compression spring to apply the brakes. Pressurized air against the diaphragm and plate is used to compress the spring. **WARNING:** Failure to comply with all instructions for mechanical release may result in the forceful release of the spring and cause death, severe personal injury and/or property damage.



GENERAL INSTRUCTIONS FOR SEALED TYPE SPRING BRAKES

There are two basic areas of failure related to service and combination chambers: Mechanical and pneumatic. Both types of failures require the spring brake to be repaired or replaced. **WARNING:** Failure to comply with all instructions for mechanical release of the spring may cause death, severe personal injury and/or property damage. To replace the parking side of a brake chamber follow these general instructions:

- 1. Always block wheels to prevent vehicle rollaway when replacing spring brake diaphragms.
- 2. If spring brake shows structural damage DO NOT cage the spring and DO NOT attempt to service it. Replace the complete unit. To prevent severe personal injury when removing an uncaged spring brake from a vehicle, cut the service push rod with an acetylene cutting torch, making sure to relieve all force on it.
- 3. Never strike any part of the spring brake with a hammer or any other heavy object; structural damage may result.
- 4. Do not drop spring brake, as the compression spring may forcefully release.
- 5. If air pressure is used to aid in the caging process, do not tighten release tool nut more than finger tight. The air pressure in the emergency chamber must always be exhausted after the spring has been mechanically caged prior to any disassembly.
- 6. On a sealed spring brake, the emergency diaphragm cannot be replaced (See Figure 20). Replace the complete piggyback unit.



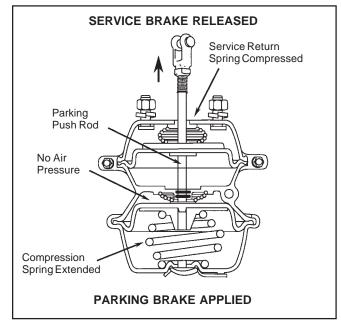


Figure 20 Figure 21

The spring extends and applies the brakes when air is exhausted from the emergency brake diaphragm. The spring will also extend if air pressure on the trailer drops below 60 psi. (See Figure 21).



MECHANICAL RELEASE OF SPRING BRAKE -ALL TYPES

DANGER: Do not attempt to mechanically release (cage) the spring when spring brake shows structural damage and/or when safety ears have been removed. Caging the spring or disassembly of the chamber may result in the forceful release of the spring chamber and its contents which could cause death, severe personal injury and/or property damage. Remove complete spring brake and replace with new unit.

* NOTICE: There are no safety ears or clamp on a Sealed Type Brake.

- 1. Remove dust plug from release tool keyhole in center of spring chamber. (Figure 22)
- 2. Remove release tool assembly from side pocket of adapter. (Figure 22)
- 3. Insert release stud through keyhole in chamber into the pressure plate. (Figure 23)
- 4. Turn release stud 1/4 turn clockwise. (Figure 23)
- 5. Pull on release stud to ensure stud crosspin is properly seated in the pressure plate. (Figure 23)
- 6. Assemble the release stud washer and nut on release stud finger tight. (Figure 24)

DANGER: The below listed instructions (step 7) only apply when spring brake is not pressurized. If air pressure is used to compress the spring, do not tighten release stud nut more than finger tight. Torquing the nut can cause pressure plate damage resulting in sudden release of the spring causing death or severe personal injury.

- 7. To cage the compression spring, tighten release stud nut with hand wrench (**DO NOT USE IMPACT WRENCH**) and make certain the push rod is retracting. (Figure 24)
 - a. DO NOT OVER TORQUE RELEASE STUD ASSEMBLY:

DANGER: Over torquing the nut can cause pressure plate damage.

S-Cam type 35 ft. lb. (47 Nm Maximum)

Wedge type 20 ft. lb. (27 Nm Maximum)

b. To ensure that the compression spring is fully caged, the stud length beyond the nut (see "X" Figure 24) should measure:

SEALED AND STEEL CHAMBER TYPES

30" Chamber- 2 7/8" Min.

24" Chamber - 2 ²⁹/₃₂" Min.

ALUMINUM CHAMBER TYPES

36" Chamber - 3 3/8" Min.

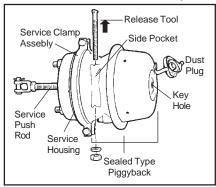
16" Chamber - 3 1/8" Min.

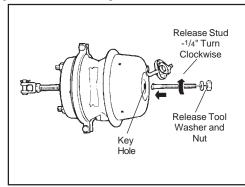
30" Chamber - 2 3/4" Min.

12" Chamber - 2 3/8" Min.

24" Chamber - 2 13/16" Min.

WARNING: If the recommended "X" dimension is not correct for chamber size and torque value, the spring brake should be considered structurally damaged. See #2 under general instructions.





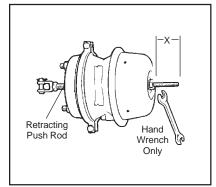


Figure 22 Figure 23 Figure 24



COMBINATION SERVICE/SPRING BRAKE INSTALLATION INSTRUCTIONS

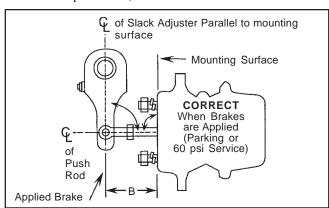
WARNING: Before installing a new combination spring brake, it is necessary to determine the correct service push rod length to insure proper alignment for efficient operation of the spring brake.

1. To determine the correct push rod length of the brake to be installed, measure the "B" dimension as shown (See Figure 25) and subtract the setup stroke as listed in Table 1. With the spring brake fully caged: "B" - Setup Stroke = Push Rod Length Including Clevis.

WARNING: Setup stroke is only to establish push rod length. (See instruction 7 on page 19.)

EXAMPLE: For a type 30 spring brake, if "B" (See Figure 25) = 5.0 inches, setup stroke = $1^{-1/2}$ inches (Table 1). The push rod length from mounting face to centerline of main clevis pin should measure: 5 minus 1 in. = $3^{-1/2}$ in. with the spring brake caged. (See Figure 26)

- 2. To mark the push rod cut-off length, the length of the threaded rod protruding between the clevis legs must not exceed ³/₁₆" to ensure no interference with the operation of the slack adjuster.
- 3. Once the proper push rod length has been marked, the push rod can be cut to length with the spring brake fully caged.
- 4. Install the clevis and jam nut on the push rod and the spring brake to the mounting bracket. (See Table 2 for installation torque). The clevis must be adjusted so that it has full thread engagement on the pushrod (from flush to 3/16" protrusion).



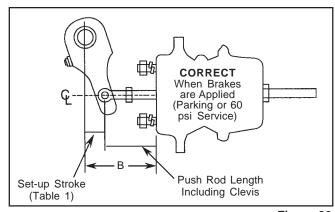


Figure 25 Figure 26

TABLE 1 - STROKE VALUES

CHAMBER	AVAILABLE STROKE	RECOMMENDED CHAMBER STROKE RANGE		SET-UP STROKE
TYPE	(INCHES)	MINIMUM	MAXIMUM	APPLIED BRAKE* ‡
20 24 24LS** 30 36	2 1/4" 2 1/4" 2 1/2" 2 1/2" 3"	(Should be as short a stroke as possible without brake dragging.)	-1 1/2" -1 1/2" -1 3/4" -1 3/4" -2 1/4"	1 3/8" 1 3/8" 1 1/2" 1 1/2" 1 3/4"

- * Stroke length measured by applying parking brake or 60 PSIG service brake application
- ** Long Stroke
- Typical setup stroke values

NOTICE: For special applications consult vehicle, brake or slack adjuster manufacturers.



COMBINATION SERVICE/SPRING BRAKE INSTALLATION INSTRUCTIONS (CONT.)

- 5. Connect the service and emergency air line to the proper air ports and the clevis to the slack adjuster and uncage the spring brake.
- 6. Adjust the slack adjuster to the listed setup stroke (Table 1). With the brake applied, the following conditions must occur:
 - a.) push rod 90° to the centerline of slack adjuster;
 - b.) push rod 90° to the mounting face of the spring brake.

If the setup results in the condition depicted in Figure 27 or Figure 28, the spring brake is misaligned and must be corrected by one or more of the following:

Figure 27 a.) shorten push rod, b.) align spring brake on mounting bracket,

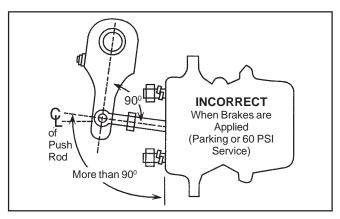
c.) mount clevis in proper slack adjuster hole.

Figure 28 a.) lengthen push rod, b.) align spring brake on mounting bracket, c.) mount clevis in proper slack adjuster hole.

If misalignment cannot be corrected, consult with foundation brake manufacturer for verification of correct mounting bracket position.

- 7. Once the spring brake and push rod are set (Figure 25), release the brakes and follow vehicle manufacturer's instruction for brake adjustment.
- 8. Reassemble release tool inside pocket of adapter and install dust plug in release tool keyhole in center of chamber.

WARNING: After installation, check for proper emergency operation, service operation and brake adjustment.



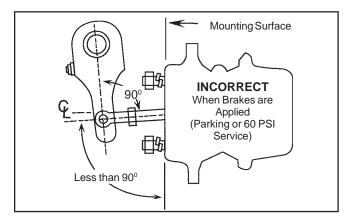


Figure 27 Figure 28

TABLE 2 INSTALLATION TORQUE VALUES

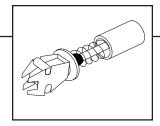
	<u>Torque</u>
Mounting nut and lock washer	110-150 lb ft.
Self-locking nut and lock washer	85-95 lb. ft.
Fine thread mounting nut and lock washer	80-100 lb. ft.
Jam nut	15-25 lb. ft.
Ports	10 max
Release Stud	25-35
Release Stud (in side pocket)	5-8 lb. ft.



TECH TIPS

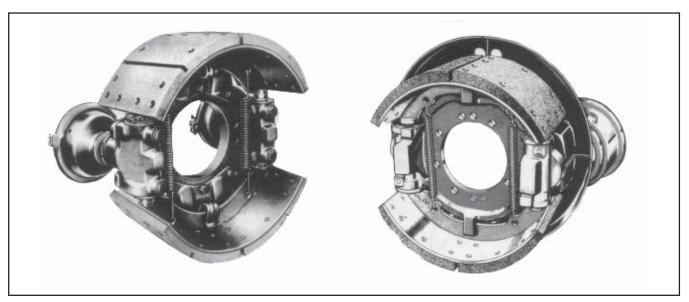
AIR WEDGE BRAKES

(Product Code 140, 141)



Air Wedge Brakes provide a good braking system when they are serviced correctly. They are more complicated in operation and service than S-Cam brakes. This issue of **Tech Tips** gives a brief description of Air Wedge Brakes.

Before attempting to service a Wedge Brake, Euclid recommends that the mechanic obtain a copy of Bendix's Service Data Manual No. SD-12-1 - "Wedge Brakes" and/or Rockwell's Field Maintenance Manual No. 4R - "Stopmaster Brakes".



Rockwell "Stopmaster"

Bendix

TYPES

There are two Air Wedge Brake systems currently in use - Bendix and Rockwell "Stopmaster". The two are similar in operation and contain the same basic components:

- · Backing Plate or Spider
- Plunger Housings
- Automatic Adjuster Assemblies
- Adjusting Plungers
- Anchor Plungers
- Wedge Assemblies
- Air Chambers
- · Brake Shoes
- Brake Shoe Return Springs

The biggest difference between the two brake systems is in the design of the automatic adjuster assemblies.

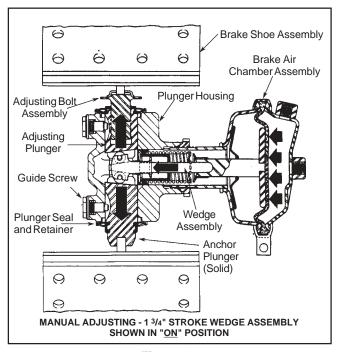


OPERATION

When air is applied to the air chamber, the air chamber push rod pushes a wedge between two rollers in the wedge assembly. The rollers spread and push the plungers outward forcing the brake shoes into the brake drum (Figure 29).

As the brake lining contacts the drum, both shoes are carried into the drum rotation. This is called "wrap-up". The force of the "wrap-up" causes the anchor plungers to "reseat" and absorb the brake torque.

When the brake is released, the wedge assembly spring retracts the wedge from between the plungers. The brake shoe return springs bring the shoes back and returns the plungers to their original "seats" in the housings (Figure 30).



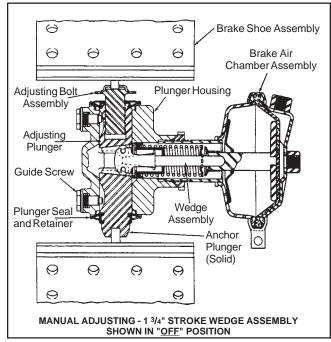


Figure 29

Figure 30

MAJOR COMPONENTS - WEDGE ASSEMBLIES

A wedge assembly consists of a wedge, two rollers, a wedge cage for holding the rollers in place, and a wedge return spring.

Wedges are made with different degree angles that are determined by the brake application. The angle degrees are marked on the wedges as shown in Figure 31.

An important, but often misunderstood point is that the smaller the degree of wedge angle, the faster the brake will apply. For example, wedge brakes with 10 degree angle wedges will apply faster than wedge brakes with 14 degree angle wedges. This is critical when balancing brakes and adjusting brake timing.

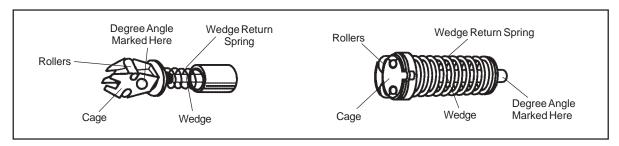




Figure 31

AIR WEDGE BRAKES TROUBLESHOOTING GUIDE

PROBLEM	CAUSES	
INSUFFICIENT BRAKE	 Brakes were not adjusted properly at initial installation. Automatic adjusters are not functioning properly. Brake block is worn out. Brake block is improper (low) friction. Grease on brake block. Plungers are frozen in the housings. Air chambers are not bottomed in housings. Leak in air system. Incorrect wedge angle. 	
BRAKES GRABBING	 Poor delivery of service air. Grease or dirt on brake block. Mis-alignment of wedge and plunger parts. Brake block is improper. Binding of brake shoes due to improper assembly, distorted shoes or worn out return springs. 	
BRAKE DRAGGING	 Spring brake power spring not releasing fully. Low spring brake hold-off pressure. Improper connection of service lines. Weak brake shoe return springs. Leaking air lines or seals. Loose wheel bearings. Wedge shaft out of push rod socket due to improper assembly. On "Stopmaster" - Plastic wedge guide is missing or broken. Plungers are binding due to improper lubrication. Broken wedge return spring and/or cotter pin. 	
SPRING BRAKES DON'T HOLD	 Air chamber tube is not bottomed in housing. Spring brake power spring is broken. Power spring is not fully uncaged. Caging bolt is damaged. Brakes are improperly adjusted. Hold-off air is not fully releasing. 	



PROBLEM	CAUSES
BRAKES ARE FROZEN OR LOCKED UP	 Spring brakes are not releasing. Insufficient air pressure in chamber. Air lines are not properly connected to the spring brake chamber. Plungers are seized in housing. Broken wedge return spring. Connecting air lines to trailer are crossed.
UNEVEN BRAKING	 Wedge shaft out of push rod socket due to improper assembly. On "Stopmaster" - Plastic wedge guide is missing or broken. Brake shoes are installed backwards. Weak brake shoe return spring. Wedge and roller assemblies are not engaging plunger slots. Brake block is not same mix on each brake assembly. DO NOT USE combination brake block. Grease or dirt on brake block. Shoe hold down clips missing or not properly holding shoes against support pads. Lightweight drums allow excessive deflection and bell-mouthing. Automatic adjusters are not functioning properly. A wedge roller is out of the cage.
AUTOMATIC ADJUSTERS ARE NOT WORKING	BENDIX 1. Weak or broken adjuster lever spring. 2. Broken adjuster lever pin. 3. Worn or broken adjuster lever or cap teeth. 4. Dislodged overload spring. 5. Improper lubrication. 6. Adjuster bolt and sleeve threads are binding. 7. Brake shoes are installed backwards. 8. Improper installation of adjuster parts. ROCKWELL "STOPMASTER" 1. Detent spring is damaged or broken. 2. Adjuster bolt and sleeve threads are binding. 3. Brake shoes are installed backwards. 4. Improper installation of adjuster parts. 5. Damaged pawl or adjuster sleeve teeth. 6. Adjuster pawl is in backwards or upside down. 7. Adjuster pawl springs have collapsed or are missing.



AUTOMATIC BRAKE ADJUSTMENT

Air Wedge Brakes include automatic adjuster assemblies that maintain the proper brake lining-to-drum clearance. The components of Bendix and Rockwell adjuster assemblies are shown in Figure 32.

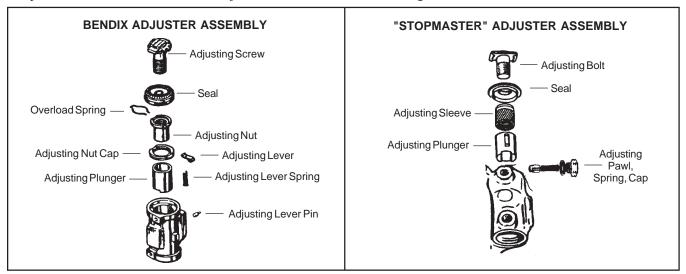


Figure 32

Although Bendix and Rockwell "Stopmaster" automatic adjusters differ in design, the principle of operation is the same. When the brakes are applied, the outward movement of the plungers moves the brake shoes against the drum. The distance the adjusting plungers move depends on the lining-to-drum clearance. If the lining is worn enough to require adjustment, the adjusting plungers will move outward enough for the adjusting lever (Bendix) or adjusting pawl (Rockwell) to pick up the next "tooth" on the adjusting cap (Bendix) or adjusting sleeve (Rockwell).

When the brakes are released, the brake shoe return springs pull the brake shoes away from the drum. This presses the plungers back into the plunger housings. The adjusting nut (Bendix) or adjusting sleeve (Rockwell) rotates and threads the adjusting bolt outward, adjusting the lining-to-drum clearance.

NOTE: Rockwell "Stopmaster" adjusting plungers are made to match the wedge angle. The correct adjusting plunger must be used.

ANCHOR PLUNGERS

Anchor plungers take the force of the brake "wrap-up". When installed in a wedge brake assembly, the forward drum rotation should always be into the anchor plungers and away from the adjuster assemblies.

Bendix uses a two-piece anchor plunger that can be installed in a right- or left-hand brake and without regard to the wedge angle.

Rockwell "Stopmaster" uses right- and left-hand one-piece anchor plungers that are marked with the wedge angle. Right-hand anchor plungers are installed in brakes on the right-hand side of the vehicle; left-hand plungers are installed on the left-hand side of the vehicle. "Stopmaster" anchor plungers must be matched to the wedge angle (See Figure 33).



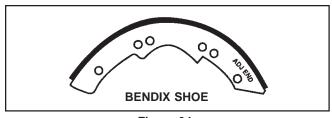
EUCLID

Figure 33

BRAKE SHOES

Both Bendix and Rockwell "Stopmaster" brake shoes must be installed correctly in the brake assembly.

Bendix shoe webs are stamped "ADJ END" on the end that fits into the slot of the adjusting bolt head (See Figure 34). **Rockwell "Stopmaster" shoe webs** have a long and short radius. The short radius fits into the slot of the anchor plunger; the long radius fits into the slot of the adjuster bolt head. "Stopmaster" shoe webs are stamped with an arrow and the words "FORWARD DRUM ROTATION". The arrow points to the short radius of the web and indicates that the forward drum rotation is toward the anchor plungers (See Figure 35).



Short Radius "STOPMASTER" SHOE Radius

Figure 34

Figure 35

BRAKE BLOCK

When asbestos brake block was used, the recommendations for wedge brakes was to use a "GG" rated friction material. This is still recommended in Rockwell's Service Manual. However, with non-asbestos brake block, there are some friction materials rated "FF" that give the same, or better, stopping performance as the old "GG" asbestos materials.

Euclid recommends the use of its "SD1" "GG", or "MB23" "FF" rated brake block depending on the specific wedge brake application. DO NOT use a combination brake block on wedge brakes.

BRAKE SHOE RETURN SPRINGS

Brake shoe return springs should always be replaced when doing a wedge brake reline. Brake shoe return springs are critical to the operation of wedge brake automatic adjusters and maintaining the correct lining-to-drum clearance.

Metal spring dampers on Bendix wedge brakes must be used to prevent spring fatigue and premature spring failure.

"Stopmaster" Push Rod Bendix Push Rod

Figure 36

AIR CHAMBERS

Bendix and Rockwell air chambers cannot be mixed due to differences in the depth of the push rods (See Figure 36).

Rockwell "Stopmaster" air chambers can be identified by a red or black plastic wedge guide over the end of the air chamber push rod.

EUCLID vs. COMPETITION

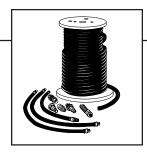
- All components must pass Euclid's strict quality control inspection.
- Euclid has the highest order-fill rate in the industry. You get the parts you need when you need them.
- Euclid publishes the easiest-to-use catalog in the industry.
- Euclid has the technical staff on hand to answer questions concerning either Bendix or "Stopmaster" Wedge Brakes.



TECH TIPS

AIR HOSE

(Product Code 130)



FUNCTION

Air brake tubes and hoses are the arteries of a vehicles air system. Their purpose is to transfer air from the air tanks to valves and brake chambers. They are designed to carry the correct volume and pressure to assure balanced effective braking. Tubing and hose are used for different purposes even though they perform the same task. Tubing is manufactured out of stiff materials like copper and nylon and are used on the vehicle where no movement occurs. Hose is manufactured to work with the vehicles suspension, connections, and points of movement. Layers of synthetic rubber and synthetic reinforcement give hose its strength and flexibility (See Figure 37).

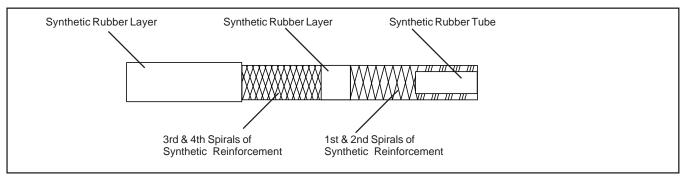


Figure 37

This design meets United States Department of Transportation (DOT), Society of Automotive Engineers, and the National Highway Traffic Safety Administration requirements.

INSPECTION

An air leak is usually a sign that a hose needs repair or replacing. Hearing an air leak is not the only reason for replacing an air hose. Prevention of your vehicle being put "out of service" on the road is another reason. "Out of service" criteria is in place to prevent problems associated with hose failure on the highway. Brake lock up, tire flat spotting, brake imbalance and accidents are a few of those problems. The published out of service criteria includes the following reasons:

- 1. Bulging and/or swelling with air applied.
- 2. Improper splice hose forced over pipe and using hose clamps to secure.
- 3. Crimp, twist or turn causing restrictions.
- 4. Cut, wear, damage through rubber cover and outer reinforcement ply.

Some manufacturers will use small vent holes to eliminate air from between the cover layer and the third and fourth spiral reinforcement layers. These vent holes will cause no problems in the life of the hose the safety of the vehicle, and do not represent an "out of service" condition (See Figure 38).

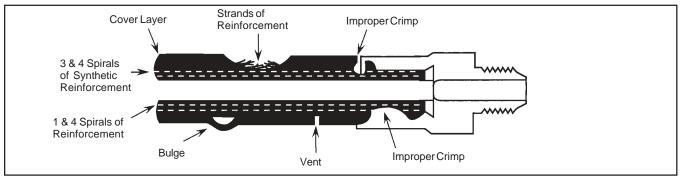


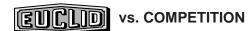
Figure 38



REPLACEMENT

The leaking or in need of replacement hose should be removed immediately. Removal and replacement is normally easy when a few guidelines are followed.

- 1. Do not splice, patch, or cover area in need of replacement.
- 2. Replace hose with a DOT approved hose of same length and inside diameter. Changing diameter and length of hose will affect brake timing.
- 3. Route hose properly to avoid wear-through problems. This routing should take into consideration the empty and loaded conditions.
- 4. Do not bend or twist hose. Twisting or excessive bends preload tension into the hose causing premature failure.
- 5. Use correct inserts, ferrules, nuts, and hose when making a replacement hose. Combining the incorrect parts could cause assembly failure.



- Over 160 separate part numbers available.
- All Euclid hose is DOT approved.
- · Hose assemblies are available boxed or unboxed.
- Hose assembly configurations available with one fixed and one swivel end or both ends swivel.



OTHER EUCLID TECHNICAL TRAINING MODULES AVAILABLE:

MODULE ONE-ONE - AIR SYSTEMS

Includes: Compressors Governors Air Dryers / Air Tanks Air Valves / Air Hoses

MODULE TWO - HYDRAULIC BRAKES

Includes: Hydraulic Wheel Cylinders Master Cylinder Hydraulic Disc Brake Rotors Hydraulic Disc Brake Calipers

MODULE THREE - WHEEL ATTACHING PARTS

Includes: Disc Wheel Parts Spoke Wheel Parts

MODULE FOUR - SUSPENSIONS

Includes: Four-Spring Suspensions Neway Air Suspensions Mack Camel Back Spring Suspension U-Bolts Uni-Rods/Maxi-Rods

Air Springs Shock Absorbers

MODULE FIVE - FRONT END PARTS

Includes:
King Pin Sets
Tie Rod Ends
Drag Links
Light-Duty Front End Parts

MODULE SIX - AIR CONDITIONING AND HEATING PARTS

MODULE SEVEN - ELECTRICAL COMPONENTS

Includes: Alternators Starters

MODULE EIGHT - ENGINE COOLING SYSTEMS

Includes: Water Pumps

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